

# Limits, Alternatives, and Choices

Chapter 1 introduces you to economics—the social science that studies how individuals, institutions, and society make the optimal best choices under conditions of scarcity. The first section of the chapter describes the three key features of the **economic perspective**. This perspective first recognizes that all choices involve costs and that these costs must be involved in an economic decision. The economic perspective also incorporates the view that to achieve a goal, people make decisions that reflect their purposeful self-interest. The third feature considers that people compare marginal benefits against marginal costs when making decisions and will choose the situation where the marginal benefit is greater than the marginal cost. You will develop a better understanding of these features as you read about the economic issues in this book.

Economics relies heavily on the **scientific method** to develop theories and principles to explain the likely effects from human events and behavior. It involves gathering data, testing hypotheses, and developing theories and principles. In essence, economic theories and principles (and related terms such as laws and models) are generalizations about how the economic world works.

Economists develop economic theories and principles at two levels: **Microeconomics** targets specific units in the economy. Studies at this level research such questions as how prices and output are determined for particular products and how consumers will react to price changes. **Macroeconomics** focuses on the whole economy, or large segments of it. Studies at this level investigate such issues as how to increase economic growth, control inflation, or maintain full employment. Studies at either level have elements of **positive economics**, which investigates facts or cause-and-effect relationships, or **normative economics**, which incorporates subjective views of what ought to be or what policies should be used to address an economic issue.

Several sections of the text are devoted to a discussion of the **economizing problem** from individual or society perspectives. This problem arises from a fundamental conflict between economic wants and economic resources: (1) individuals and society have *unlimited* economic wants; (2) the economic means or resources to satisfy those wants are *limited*. This economic problem forces individuals and societies to make a choice. And anytime a choice is made there is an opportunity cost—the next best alternative that was not chosen.

The economizing problem for individuals is illustrated with a microeconomic model that uses a **budget line**. It shows graphically the meaning of many concepts defined

in the chapter: scarcity, choice, trade-offs, opportunity cost, and optimal allocation. The economizing problem for society is illustrated with a macroeconomics model that uses a **production possibilities curve**. It also shows graphically the economic concepts just listed, and in addition it can be used to describe macroeconomic conditions related to unemployment, economic growth, and trade. The production possibilities model can also be applied to many real economic situations, such as the economics of war, as you will learn from the text.

## ■ CHECKLIST

When you have studied this chapter you should be able to

- ☐ Write a formal definition of economics.
- ☐ Describe the three key features of the economic perspective.
- ☐ Give applications of the economic perspective.
- ☐ Identify the elements of the scientific method.
- ☐ Define hypothesis, theory, principle, law, and model as they relate to economics.
- ☐ State how economic principles are generalizations and abstractions.
- ☐ Explain the "other-things-equal" assumption (*ceteris paribus*) and its use in economics.
- ☐ Distinguish between microeconomics and macroeconomics.
- ☐ Give examples of positive and normative economics.
- ☐ Explain the economizing problem for an individual (from a microeconomic perspective).
- ☐ Describe the concept of a budget line for the individual.
- ☐ Explain how to measure the slope of a budget line and determine the location of the budget line.
- ☐ Use the budget line to illustrate trade-offs and opportunity costs.
- ☐ Describe the economizing problem for society.
- ☐ Define the four types of economic resources for society.
- ☐ State the four assumptions made when a production possibilities table or curve is constructed.
- ☐ Construct a production possibilities curve when given the data.
- ☐ Define opportunity cost and utilize a production possibilities curve to explain the concept.
- ☐ Show how the law of increasing opportunity costs is reflected in the shape of the production possibilities curve.
- ☐ Explain the economic rationale for the law of increasing opportunity costs.

inal analysis to define optimal allocation.  
 ow optimal allocation determines the optimal  
 oduction possibilities curve.  
 roduction possibilities curve to illustrate  
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 ow international trade affects a nation's pro-  
 abilities curve.  
 r applications of the production possibilities  
 he five pitfalls to sound economic reasoning

## OUTLINE

**ics** studies how individuals, institutions, and  
 e the optimal or best choices under conditions  
 or which economic wants are *unlimited* and the  
 sources to satisfy those wants are *limited*.

**onomic perspective** has three interrelated

ognizes that scarcity requires choice, and that  
 a choice has an **opportunity cost**—giving up  
 best alternative to the choice that was made.  
 ws people as purposeful decision makers who  
 oices based on their self-interests. People seek  
 se their satisfaction, or **utility**, from consuming  
 or service. They are purposeful because they  
 re costs and benefits in deciding how best to  
 e that utility.

is **marginal analysis** to assess how the marginal  
 a decision compare with the marginal benefits.

ics relies on the **scientific method** for analysis.  
 aral terms are used in economic analysis that  
 ted to this method.

**hypothesis** is a proposition that is tested and  
 develop an economic **theory**.

ighly tested and reliable economic theory is  
 an **economic principle** or **law**. Theories, prin-  
 and laws are meaningful statements about eco-  
 behavior or the economy that can be used to  
 the likely outcome of an action or event.  
 economic **model** is created when several eco-  
 aws or principles are used to explain or describe

re are several other aspects of economic  
 les.

ch principle or theory is a generalization that  
 a tendency or average effect.

e **other-things-equal assumption** (*ceteris pari-*  
 used to limit the influence of other factors when  
 g a generalization.

any economic models can be illustrated graphically  
 e, simplified representations of economic reality.

mic analysis is conducted at two levels, and for  
 el there can be elements of positive or normative

a. **Microeconomics** studies the economic behavior of  
 individuals, particular markets, firms, or industries.

b. **Macroeconomics** looks at the entire economy or  
 its major **aggregates** or sectors, such as households,  
 businesses, or government.

c. **Positive economics** focuses on facts and is con-  
 cerned with what is, or the scientific analysis of eco-  
 nomic behavior.

d. **Normative economics** suggests what ought to be  
 and answers policy questions based on value judg-  
 ments. Most disagreements among economists involve  
 normative economics.

5. Individuals face an **economizing problem** because  
 economic wants are greater than the economic means  
 to satisfy those wants. It can be illustrated with a micro-  
 economic model with several features.

a. Individuals have limited income to spend.

b. Individuals have virtually unlimited wants for more  
 goods and services; and higher-quality goods and  
 services.

c. The economizing problem for the individual can  
 be illustrated with a budget line and two products (for  
 instance, DVDs and books). The **budget line** shows  
 graphically the combinations of the two products a con-  
 sumer can purchase with his or her money income.

(1) All combinations of the two products on or inside  
 the budget line are **attainable** by the consumer; all com-  
 binations beyond the budget line are **unattainable**.

(2) To obtain more DVDs the consumer has to give up  
 some books, so there is a **trade-off**; if to get a second  
 DVD the consumer must give up two books, then the  
**opportunity cost** of the additional DVD is two books.

(3) Limited income forces individuals to evaluate the  
 marginal cost and marginal benefit of a choice to maxi-  
 mize their satisfaction.

(4) Changes in money income shift the budget line:  
 an increase in income shifts the line to the right; a  
 decrease in income shifts the line to the left.

6. Society also faces an economizing problem due to  
 scarcity.

a. **Economic resources** are scarce natural, human,  
 or manufactured inputs used to produce goods and  
 services.

b. Economic resources are sometimes called **factors  
 of production** and are classified into four categories:

(1) **land**, or natural resources.

(2) **labor**, or the contributed time and abilities of peo-  
 ple who are producing goods and services.

(3) **capital** (or capital goods), or the machines, tools,  
 and equipment used to make other goods and ser-  
 vices; economists refer to the purchase of such capital  
 goods as **investment**.

(4) **entrepreneurial ability**, or the special human tal-  
 ents of individuals who combine the other factors of  
 production.

7. A macroeconomic model of production possibilities il-  
 lustrates the economizing problem for society. The four  
 assumptions usually made when such a production pos-  
 sibilities model is used are: (1) there is full employment

of available resources; (2) the quantity and quality of resources are fixed; (3) the state of technology does not change; and, (4) there are two types of goods being produced (*consumer goods* and *capital goods*).

a. The **production possibilities table** indicates the alternative combinations of goods an economy is capable of producing when it has achieved full employment and optimal allocation. The table illustrates the fundamental choice every economy must make: what quantity of each product it must sacrifice to obtain more of another.

b. The data in the production possibilities table can be plotted on a graph to obtain a **production possibilities curve**. Each point on the curve shows some maximum output of the two goods.

c. The opportunity cost of producing an additional unit of one good is the amount of the other good that is sacrificed. The **law of increasing opportunity costs** states that the opportunity cost of producing one more unit of a good (the marginal opportunity cost) increases as more of the good is produced.

(1) The production possibilities curve is bowed out from the origin because of the law of increasing opportunity costs.

(2) The reason the opportunity cost of producing an additional unit of a good increases as more of it is produced is because resources are not completely adaptable to alternative uses.

d. Optimal allocation means that resources are devoted to the best mix of goods to maximize satisfaction in society. This optimal mix is determined by assessing marginal costs and benefits.

(1) The marginal-cost curve for a good increases because of the law of increasing opportunity costs; the marginal-benefit curve decreases because the consumption of a good yields less and less satisfaction.

(2) When the marginal benefit is greater than the marginal cost, there is an incentive to produce more of the good, but when the marginal cost is greater than the marginal benefit there is an incentive to produce less of the good.

(3) Optimal or efficient allocation is achieved when the marginal cost of a product equals the marginal benefit of a product.

8. Different outcomes will occur when assumptions underlying the production possibilities model are relaxed.

a. Unemployment. When the economy is operating at a point inside the production possibilities curve it means that resources are not fully employed.

b. **Economic growth**. The production possibilities curve shifts outward from economic growth because resources are no longer fixed and technology improves.

(1) Expansion in the quantity and quality of resources contributes to economic growth and shifts the production possibilities curve outward.

(2) Advancement in technology contributes to economic growth and also shifts the production possibilities curve outward.

(3) The combination of capital goods and consumer goods an economy chooses to produce in the present can determine the position of the production possibilities

curve in the future. Greater production of capital goods relative to consumer goods in the present shifts the production possibilities curve farther outward in the future because that economy is devoting more of its resources to investment than consumption.

c. Trade. When there is international specialization and trade, a nation can obtain more goods and services than is indicated by the production possibilities curve for a domestic economy. The effect on production possibilities is similar to an increase in economic growth.

9. (Last Word). Sound reasoning about economic issues requires the avoidance of five pitfalls.

a. *Bias* is a preconceived belief or opinion that is not warranted by the facts.

b. *Loaded terminology* is the use of terms in a way that appeals to emotion and leads to a nonobjective analysis of the issues.

c. The *fallacy of composition* is the assumption that what is true of the part is necessarily true of the whole.

d. The *post hoc fallacy* ("after this, therefore because of this") is the mistaken belief that when one event precedes another, the first event is the cause of the second.

e. *Confusing correlation with causation* means that two factors may be related, but that does not mean that one factor caused the other.

#### ■ HINTS AND TIPS

1. The **economic perspective** presented in the first section of the chapter has three features related to decision making: scarcity and the necessity of choice, purposeful self-interest in decision making, and marginal analysis of the costs and benefits of decisions. Although these features may seem strange to you at first, they are central to the economic thinking used to examine decisions and problems throughout the book.

2. The chapter introduces two pairs of terms: **microeconomics** and **macroeconomics**; and, **positive economics** and **normative economics**. Make sure you understand what each pair means and how they are related to each other.

3. The **budget line** shows the consumer what it is possible to purchase in the two-good world, given an income. Make sure that you understand what a budget line is. To test your understanding, practice with different income levels and prices. For example, assume you had an income of \$100 to spend for two goods (A and B). Good A costs \$10 and Good B costs \$5. Draw a budget line to show the possible combinations of A and B that you could purchase.

4. The **production possibilities curve** is a simple and useful economic model for an economy. Practice your understanding of it by using it to explain the following economic concepts: scarcity, choice, opportunity cost, the law of increasing opportunity costs, full employment, optimal allocation, unemployment, and economic growth.

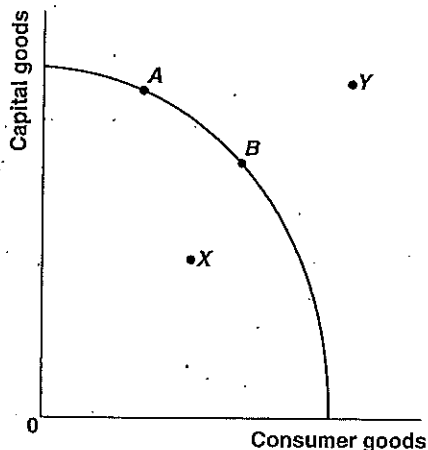
5. **Opportunity cost** is always measured in terms of a forgone alternative. From a production possibilities table, you can easily calculate how many units of one product you forgo when you get another unit of a product.

14. Goods that satisfy economic wants directly are (consumer, capital goods) \_\_\_\_\_, and goods that do so indirectly by helping produce other goods are \_\_\_\_\_ goods. Assume an economy can produce two basic types of goods, consumer and capital goods. If the economy wants to produce more consumer goods, then the capital goods the economy must give up are the opportunity (benefit, cost) \_\_\_\_\_ of producing those additional consumer goods.

15. The law of increasing opportunity costs explains why the production possibilities curve is (convex, concave) \_\_\_\_\_ from the origin. The economic rationale for the law is that economic resources (are, are not) \_\_\_\_\_ completely adaptable to alternative uses.

16. Optimal allocation of resources to production occurs when the marginal costs of the productive output are (greater than, less than, equal to) \_\_\_\_\_ the marginal benefits.

17. Following is a production possibilities curve for capital goods and consumer goods.



a. If the economy moves from point A to point B, it will produce (more, fewer) \_\_\_\_\_ capital goods and (more, fewer) \_\_\_\_\_ consumer goods.

b. If the economy is producing at point X, some resources in the economy are either (not available, unemployed) \_\_\_\_\_ or (underemployed, overemployed) \_\_\_\_\_.

c. If the economy moves from point X to point B (more, fewer) \_\_\_\_\_ capital goods and (more, fewer) \_\_\_\_\_ consumer goods will be produced.

d. If the economy is to produce at point Y, there must be (unemployment, economic growth) \_\_\_\_\_.

18. Economic growth will shift a nation's production possibilities curve (inward, outward) \_\_\_\_\_, and it

occurs because of a resource supply (decrease, increase) \_\_\_\_\_ or because of a technological (decline, advance) \_\_\_\_\_.

19. An economy can produce goods for the present such as (consumer, capital) \_\_\_\_\_ goods and goods for the future such as \_\_\_\_\_ goods. If an economy produces more goods for the future, then this is likely to lead to a (greater, smaller) \_\_\_\_\_ shift outward in the production possibilities curve over time compared to the case where the economy produces more goods for the present.

20. International specialization and trade enable a nation to obtain (more, less) \_\_\_\_\_ of output than is possible with the output limits imposed by domestic production possibilities. The gains in output for an economy from greater international specialization and trade are similar to those that occur because of resource (increases, decreases) \_\_\_\_\_ or a technological (decline, advance) \_\_\_\_\_.

#### ■ TRUE-FALSE QUESTIONS

Circle T if the statement is true, F if it is false.

1. Economics is the social science that studies how individuals, institutions, and society make choices under conditions of scarcity. T F

2. From the economic perspective, "there is no such thing as a free lunch." T F

3. The economic perspective views individuals or institutions as making purposeful choices based on the marginal analysis of the costs and benefits of decisions. T F

4. The scientific method involves the observation of real world data, the formulation of hypotheses based on the data, and the testing of those hypotheses to develop theories. T F

5. A well-tested or widely accepted economic theory is often called an economic principle or law. T F

6. The other-things-equal assumption (*ceteris paribus*) is made to simplify the economic analysis. T F

7. Microeconomic analysis is concerned with the performance of the economy as a whole or its major aggregates. T F

8. Macroeconomic analysis is concerned with the economic activity of specific firms or industries. T F

9. The statement that "the legal minimum wage should be raised to give working people a decent income" is an example of a normative statement. T F

10. A person is using positive economics when the person makes value judgments about how the economy should work. T F

11. The conflict between the scarce economic wants of individuals or societies and limited economic means and resources of individuals or societies gives rise to the economizing problem. T F

12. The budget line shows all combinations of two products that the consumer can purchase, given money income and the prices of the products. T F

13. A consumer is unable to purchase any of the combinations of two products which lie below (or to the left) of the consumer's budget line. T F

14. An increase in the money income of a consumer shifts the budget line to the right. T F

15. The factors of production are land, labor, capital, and entrepreneurial ability. T F

16. From the economist's perspective, investment refers to money income. T F

17. Given full employment and optimal allocation, it is not possible for an economy capable of producing just two goods to increase its production of both at any one point in time. T F

18. The opportunity cost of producing more consumer goods is the other goods and services the economy is unable to produce because it has decided to produce these additional consumer goods. T F

19. The opportunity cost of producing a good tends to increase as more of it is produced because resources less suitable to its production must be employed. T F

20. Drawing a production possibilities curve bowed out from the origin is a graphical way of showing the law of increasing opportunity costs. T F

21. The economic rationale for the law of increasing opportunity costs is that economic resources are fully adaptable to alternative uses. T F

22. Optimal allocation is determined by assessing the marginal costs and benefits of the output from the allocation of resources to production. T F

23. Economic growth means an increase in the production of goods and services and is shown by a movement of the production possibilities curve outward and to the right. T F

24. The more capital goods an economy produces today, the greater will be the total output of all goods it can produce in the future, other things being equal. T F

25. International specialization and trade permit an economy to overcome the limits imposed by domestic production possibilities and have the same effect on the economy as having more and better resources. T F

## ■ MULTIPLE-CHOICE QUESTIONS

Circle the letter that corresponds to the best answer.

- What statement would best complete a short definition of economics? "Economics studies"
  - how businesses produce goods and services
  - the equitable distribution of society's income and wealth
  - the printing and circulation of money throughout the economy
  - how individuals, institutions, and society make optimal choices under conditions of scarcity
- The idea in economics that "there is no such thing as a free lunch" means that
  - the marginal benefit of such a lunch is greater than its marginal cost
  - businesses cannot increase their market share by offering free lunches
  - scarce resources have alternative uses or opportunity costs
  - consumers are irrational when they ask for a free lunch
- The opportunity cost of a new public stadium is the
  - money cost of hiring guards and staff for the new stadium
  - cost of constructing the new stadium in a future year
  - change in the real estate tax rate to pay off the new stadium
  - other goods and services that must be sacrificed to construct the new stadium
- From the economic perspective, when a business decides to employ more workers, the business decision maker has most likely concluded that the marginal
  - costs of employing more workers have decreased
  - benefits of employing more workers have increased
  - benefits of employing more workers are greater than the marginal costs
  - costs of employing more workers are not opportunity costs for the business because more workers are needed to increase production
- The combination of economic theories or principles into a simplified representation of reality is referred to as an economic:
  - fact
  - model
  - assumption
  - hypothesis
- Which would be studied in microeconomics?
  - the output of the entire U.S. economy
  - the general level of prices in the U.S. economy
  - the output and price of wheat in the United States
  - the total number of workers employed in the United States

7. When we look at the whole economy or its major aggregates, our analysis would be at the level of

- (a) microeconomics
- (b) macroeconomics
- (c) positive economics
- (d) normative economics

8. Which is a normative economic statement?

- (a) The consumer price index rose 1.2 percent last month.
- (b) The unemployment rate of 6.8 percent is too high.
- (c) The average rate of interest on loans is 4.6 percent.
- (d) The economy grew at an annual rate of 3.6 percent.

9. Sandra states that "there is a high correlation between consumption and income." Arthur replies that the correlation occurs because "people consume too much of their income and don't save enough."

- (a) Both Sandra's and Arthur's statements are positive.
- (b) Both Sandra's and Arthur's statements are normative.
- (c) Sandra's statement is positive and Arthur's statement is normative.
- (d) Sandra's statement is normative and Arthur's statement is positive.

10. Assume that a consumer can buy only two goods, *A* and *B*, and has an income of \$100. The price of *A* is \$10 and the price of *B* is \$20. The maximum amount of *A* the consumer is able to purchase is

- (a) 5
- (b) 10
- (c) 20
- (d) 30

11. Assume that a consumer can buy only two goods, *A* and *B*, and has an income of \$100. The price of *A* is \$10 and the price of *B* is \$20. What is the slope of the budget line if *A* is measured horizontally and *B* is measured vertically?

- (a) -0.5
- (b) -1.0
- (c) -2.0
- (d) -4.0

12. Tools, machinery, or equipment used to produce other goods would be examples of

- (a) public goods
- (b) capital goods
- (c) social goods
- (d) consumer goods

13. An "innovator" is defined as an entrepreneur who

- (a) makes basic policy decisions in a business firm
- (b) combines factors of production to produce a good or service
- (c) invents a new product or process for producing a product
- (d) introduces new products on the market or employs a new method to produce a product

14. When a production possibilities schedule is written (or a production possibilities curve is drawn) in this chapter,

four assumptions are made. Which is one of those assumptions?

- (a) The state of technology changes.
- (b) More than two products are produced.
- (c) The economy has full employment of available resources.
- (d) The quantities of all resources available to the economy are variable, not fixed.

Answer Questions 15, 16, and 17 on the basis of the data given in the following production possibilities table.

	Production possibilities (alternatives)					
	A	B	C	D	E	F
Capital goods	100	95	85	70	50	0
Consumer goods	0	100	180	240	280	300

15. If the economy is producing at production alternative *D*, the opportunity cost of 40 more units of consumer goods is

- (a) 5 units of capital goods
- (b) 10 units of capital goods
- (c) 15 units of capital goods
- (d) 20 units of capital goods

16. In the table above, the law of increasing opportunity costs is suggested by the fact that

- (a) capital goods are relatively more scarce than consumer goods
- (b) greater and greater quantities of consumer goods must be given up to get more capital goods
- (c) smaller and smaller quantities of consumer goods must be given up to get more capital goods
- (d) the production possibilities curve will eventually shift outward as the economy expands

17. The present choice of alternative *B* compared with alternative *D* would tend to promote

- (a) increased consumption in the present
- (b) decreased consumption in the future
- (c) a greater increase in economic growth in the future
- (d) a smaller increase in economic growth in the future

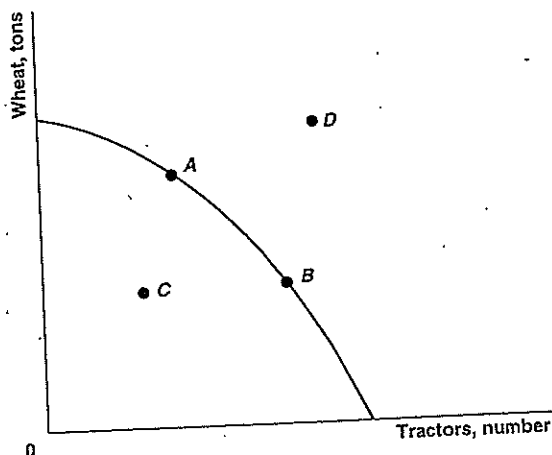
18. What is the economic rationale for the law of increasing opportunity costs?

- (a) Optimal allocation and full employment of resources have not been achieved.
- (b) Economic resources are not completely adaptable to alternative uses.
- (c) Economic growth is being limited by the pace of technological advancement.
- (d) An economy's present choice of output is determined by fixed technology and fixed resources.

19. The underallocation of resources by society to the production of a product means that the

- (a) marginal benefit is greater than the marginal cost
- (b) marginal benefit is less than the marginal cost
- (c) opportunity cost of production is rising
- (d) consumption of the product is falling

Answer Questions 20, 21, and 22 based on the following graph for an economy.



20. Unemployment and productive inefficiency would best be represented in the graph by point:

- (a) A
- (b) B
- (c) C
- (d) D

21. The choice of point B over point A as the optimal product mix for society would be based on

- (a) the state of technology
- (b) full employment of resources
- (c) the law of increasing opportunity costs
- (d) a comparison of marginal costs and benefits

22. Economic growth could be represented by

- (a) a movement from point A to point B
- (b) a movement from point B to point A
- (c) a shift in the production possibilities curve out to point C
- (d) a shift in the production possibilities curve out to point D

23. If there is an increase in the resources available within the economy,

- (a) the economy will be capable of producing fewer goods
- (b) the economy will be capable of producing more goods
- (c) the standard of living in the economy will decline
- (d) the state of technology will deteriorate

24. Which situation would most likely shift the production possibilities curve for a nation in an outward direction?

- (a) deterioration in product quality
- (b) reductions in the supply of resources
- (c) increases in technological advance
- (d) rising levels of unemployment

25. You observe that more education is associated with more income and conclude that more income leads to more education. This would be an example of

- (a) the post hoc fallacy
- (b) the fallacy of composition

- (c) confusing correlation and causation
- (d) using the other-things-equal assumption

## ■ PROBLEMS

1. Use the appropriate number to match the terms with the phrases below.

- |                       |                        |
|-----------------------|------------------------|
| 1. economics          | 4. normative economics |
| 2. microeconomics     | 5. macroeconomics      |
| 3. positive economics | 6. marginal analysis   |

a. The attempt to establish scientific statements about economic behavior; a concern with "what is" rather than "what ought to be."

b. Part of economics that involves value judgments about what the economy should be like or the way the economic world should be.

c. Social science that studies how individuals, institutions, and society make optimal choices under conditions of scarcity.

d. Part of economics concerned with the economic behavior of individual units such as households, firms, and industries (particular markets).

e. The comparison of additional benefits and additional costs.

f. Part of economics concerned with the whole economy or its major sectors.

2. **News report:** "The worldwide demand for wheat from the United States increased and caused the price of wheat in the United States to rise." This is a *specific* instance of a more *general* economic principle. Of which economic *generalization* is this a particular example?

3. Following is a list of economic statements. Indicate in the space to the right of each statement whether it is positive (P) or normative (N). Then, in the last four lines below, write two of your own examples of positive economic statements and two examples of normative economic statements.

a. New York City should control the rental price of apartments.

b. Consumer prices rose at an annual rate of 4% last year.

c. Most people who are unemployed are just too lazy to work.

d. Generally, if you lower the price of a product, people will buy more of that product.

e. The profits of oil companies are too large and ought to be used to conduct research on alternative energy sources. \_\_\_\_\_

f. Government should do more to help the poor. \_\_\_\_\_

g. \_\_\_\_\_ P

h. \_\_\_\_\_ -P

i. \_\_\_\_\_ N

j. \_\_\_\_\_ N

4. Following is a list of resources. Indicate in the space to the right of each whether the resource is land (LD), labor (LR), capital (C), entrepreneurial ability (EA), or some combinations of these resources.

a. Fishing grounds in the North Atlantic \_\_\_\_\_

b. A computer in a retail store \_\_\_\_\_

c. Oil shale deposits in Canada \_\_\_\_\_

d. An irrigation ditch in Nebraska \_\_\_\_\_

e. Bill Gates in his work in starting Microsoft \_\_\_\_\_

f. The oxygen breathed by human beings \_\_\_\_\_

g. A McDonald's restaurant in Rochester, Minnesota \_\_\_\_\_

h. The shelves of a grocery store \_\_\_\_\_

i. A machine in an auto plant \_\_\_\_\_

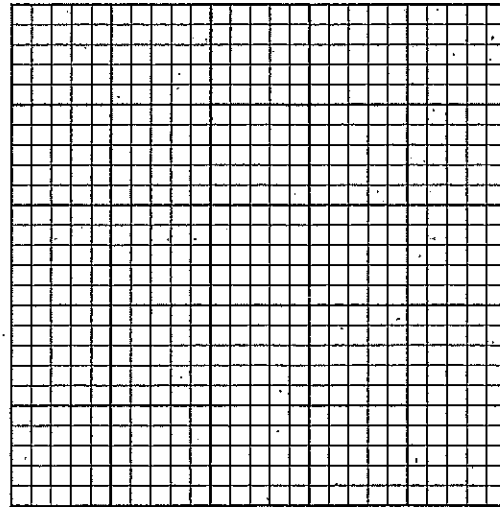
j. A person who creates a new website and uses it to start a successful business \_\_\_\_\_

k. A carpenter working for a construction company that is building a house \_\_\_\_\_

5. Following is a production possibilities table for two products, corn and cars. The table is constructed using the usual assumptions. Corn is measured in units of 100,000 bushels and cars in units of 100,000.

Combination	Corn	Cars
A	0	7
B	7	6
C	13	5
D	18	4
E	22	3
F	25	2
G	27	1
H	28	0

a. Follow the general rules for making graphs (see the appendix to Chapter 1); plot the data from the table on the graph below to obtain a production possibilities curve. Place corn on the vertical axis and cars on the horizontal axis.



b. Fill in the following table showing the opportunity cost per unit of producing the 1st through the 7th car unit in terms of corn units.

Cars	Cost of production
1st	_____
2nd	_____
3rd	_____
4th	_____
5th	_____
6th	_____
7th	_____

c. What is the *marginal* opportunity cost of the 3rd car unit in terms of units of corn? \_\_\_\_\_

d. What is the *total* opportunity cost of producing 6 car units in terms of units of corn? \_\_\_\_\_

#### ■ SHORT ANSWER AND ESSAY QUESTIONS

1. What are the three interrelated features of the economic perspective?

2. What is the economic meaning of the statement "there is no such thing as a free lunch"?

3. What are the differences and similarities among the terms *hypothesis*, *theory*, *principle*, *law*, and *model*?

4. Why do economists use the "other things equal" assumption?

5. Why are economic principles necessarily generalized and abstract?

6. Explain the difference between microeconomics and macroeconomics.



7. What are some current examples of positive economic statements and normative economic statements?
8. Explain what the term "economizing problem" means for an individual and for society.
9. What is a budget line for an individual? How can it be used to illustrate trade-offs and opportunity costs?
10. What are the four economic resources? How is each resource defined?
11. What four assumptions are made in drawing a production possibilities curve or schedule?
12. What is the law of increasing opportunity costs? Why do opportunity costs increase?
13. What determines the optimal product mix for society's production possibilities?
14. How can unemployment be illustrated with the production possibilities curve?
15. What will be the effect of increasing resource supplies on production possibilities?
16. Describe how technological advances will affect the production possibilities curve.
17. Explain the trade-off between goods for the present and goods for the future and the effect of this trade-off on economic growth.
18. What qualification does international specialization and trade make for the interpretation of production possibilities?
19. Explain how the production possibilities curve can be used to explain the economics of war.
20. Explain each of the five pitfalls to sound economic reasoning.

13. a. there is full employment and optimal allocation; b. the available supplies of the factors of production are fixed; c. technology does not change during the course of the analysis; d. the economy produces only two products (any order for a-d)
14. consumer, capital, cost
15. concave, are not
16. equal to
17. a. fewer, more; b. unemployed, underemployed; c. more, more; d. economic growth
18. outward, increase, advance
19. consumer, capital, greater
20. more, increases, advance

## TRUE-FALSE QUESTIONS

- |               |                   |                  |
|---------------|-------------------|------------------|
| 1. T, p. 4    | 10. F, p. 7       | 19. T, p. 13     |
| 2. T, p. 4    | 11. T, pp. 7, 10  | 20. T, pp. 12-13 |
| 3. T, pp. 4-5 | 12. T, pp. 8-9    | 21. F, p. 13     |
| 4. T, pp. 5-6 | 13. F, p. 9       | 22. T, p. 13     |
| 5. T, p. 6    | 14. T, p. 10      | 23. T, p. 15     |
| 6. T, p. 6    | 15. T, pp. 10-11  | 24. T, pp. 17-18 |
| 7. F, p. 6    | 16. F, p. 10      | 25. T, p. 18     |
| 8. F, pp. 6-7 | 17. T, pp. 11, 13 |                  |
| 9. T, p. 7    | 18. T, pp. 12-13  |                  |

## MULTIPLE-CHOICE QUESTIONS

- |               |                  |                  |
|---------------|------------------|------------------|
| 1. d, p. 4    | 10. b, p. 8      | 19. a, pp. 13-14 |
| 2. c, p. 4    | 11. a, pp. 8-9   | 20. c, pp. 14-15 |
| 3. d, p. 4    | 12. b, p. 10     | 21. d, pp. 13-14 |
| 4. c, p. 5    | 13. d, pp. 10-11 | 22. d, pp. 15-16 |
| 5. b, pp. 5-6 | 14. c, p. 11     | 23. b, p. 15     |
| 6. c, p. 6    | 15. d, p. 11     | 24. c, pp. 15-16 |
| 7. b, p. 6-7  | 16. b, pp. 11-12 | 25. c, pp. 16-17 |
| 8. b, p. 7    | 17. c, p. 15     |                  |
| 9. c, p. 7    | 18. b, p. 13     |                  |

## PROBLEMS

1. a. 3; b. 4; c. 1; d. 2; e. 6; f. 5
2. An increase in the demand for an economic good will cause the price of that good to rise.
3. a. N; b. P; c. N; d. P; e. N; f. N
4. a. LD; b. C; c. LD; d. C; e. EA; f. LD; g. C; h. C; i. C; j. EA; k. LR
5. b. 1, 2, 3, 4, 5, 6, 7 units of corn; c. 3; d. 21

## SHORT ANSWER AND ESSAY QUESTIONS

- |            |               |               |
|------------|---------------|---------------|
| 1. pp. 4-5 | 8. pp. 7, 10  | 15. pp. 15-16 |
| 2. p. 4    | 9. pp. 8-10   | 16. p. 16     |
| 3. pp. 5-6 | 10. pp. 10-11 | 17. pp. 17-18 |
| 4. p. 6    | 11. p. 11     | 18. p. 18     |
| 5. p. 6    | 12. pp. 12-13 | 19. p. 14     |
| 6. pp. 6-7 | 13. p. 13     | 20. pp. 16-17 |
| 7. p. 7    | 14. pp. 14-15 |               |

## ANSWERS

## Chapter 1 Limits, Alternatives, and Choices

## FILL-IN QUESTIONS

1. scarcity, cost, alternative
2. purposeful, marginal
3. scientific, theories, principles, laws, models
4. generalizations, do not, other-things-equal (or *ceteris paribus*)
5. microeconomics, macroeconomics
6. aggregate
7. positive, normative, normative
8. unlimited, limited
9. buy, a budget
10. attainable, unattainable
11. right, left
12. a. land or natural resources; b. labor; c. capital; d. entrepreneurial ability

# Graphs and Their Meaning

This appendix introduces graphing in economics. Graphs help illustrate and simplify the economic theories and models presented throughout this book. The old saying that "a picture is worth 1000 words" applies to economics; graphs are the way that economists "picture" relationships between economic variables.

You must master the basics of graphing if these "pictures" are to be of any help to you. This appendix explains how to achieve that mastery. It shows you how to construct a graph from a table with data of two variables, such as income and consumption.

Economists usually, but not always, place the **independent variable** (income) on the horizontal axis and the **dependent variable** (consumption) on the vertical axis of the graph. Once the data points are plotted and a line drawn to connect the plotted points, you can determine whether there is a **direct** or an **inverse relationship** between the variables. Identifying direct and inverse relationships between variables is an essential skill used repeatedly in this book.

Information from data in graphs and tables can be written in an equation. This work involves determining the **slope** and **intercept** from a straight line in a graph or data in a table. Using values for the slope and intercept, you can write a **linear equation** that will enable you to calculate what the dependent variable would be for a given level of the independent variable.

Some graphs used in the book are **nonlinear**. With **nonlinear curves**, the slope of the line is no longer constant throughout but varies as one moves along the curve. This slope can be estimated at a point by determining the slope of a straight line that is drawn tangent to the curve at that point. Similar calculations can be made for other points to see how the slope changes along the curve.

## ■ APPENDIX CHECKLIST

When you have studied this appendix you should be able to

- ☐ Explain why economists use graphs.
- ☐ Construct a graph of two variables using the numerical data from a table.
- ☐ Make a table with two variables from data on a graph.
- ☐ Distinguish between a direct and an inverse relationship when given data on two variables.
- ☐ Identify dependent and independent variables in economic examples and graphs.

- ☐ Describe how economists use the other-things-equal assumption (*ceteris paribus*) in graphing two variables.
- ☐ Calculate the slope of a straight line between two points when given the tabular data, and indicate whether the slope is positive or negative.
- ☐ Describe how slopes are affected by the choice of the units of measurement for either variable.
- ☐ Explain how slopes are related to marginal analysis.
- ☐ Graph infinite or zero slopes and explain their meaning.
- ☐ Determine the vertical intercept for a straight line in a graph with two variables.
- ☐ Write a linear equation using the slope of a line and the vertical intercept; when given a value for the independent variable, determine a value for the dependent variable.
- ☐ Estimate the slope of a nonlinear curve at a point using a line that is tangent to the curve at that point.

## ■ APPENDIX OUTLINE

1. Graphs illustrate the relationship between variables and give economists and students another way, in addition to verbal explanation, of understanding economic phenomena. Graphs are aids in describing economic theories and models.
2. The construction of a simple graph involves plotting the numerical data of two variables from a table.
  - a. Each graph has a **horizontal axis** and a **vertical axis** that can be labeled for each variable and then scaled for the range of the data point that will be measured on the axis.
  - b. Data points are plotted on the graph by drawing straight lines from the scaled points on the two axes to the place on the graph where the straight lines intersect.
  - c. A line or curve can then be drawn to connect the points plotted on the graph. If the graph is a straight line, it is **linear**. (It is acceptable and typical to call these straight lines "curves.")
3. A graph provides information about relationships between variables.
  - a. An upward-sloping line to the right on a graph indicates that there is a positive or **direct relationship** between two variables: an increase in one is associated with an increase in the other; a decrease in one is associated with a decrease in the other.
  - b. A downward-sloping line to the right means that there is a negative or **inverse relationship** between

- the two variables: an increase in one is associated with a decrease in the other; a decrease in one is associated with an increase in the other.
4. Economists are often concerned with determining cause and effect in economic events.
- a. A *dependent variable* changes (increases or decreases) because of a change in another variable.
- b. An *independent variable* produces or "causes" the change in the dependent variable.
- c. In a graph, mathematicians place an independent variable on the horizontal axis and a dependent variable on the vertical axis; economists are more arbitrary in the placement of the dependent or independent variable on an axis.
5. Economic graphs are simplifications of economic relationships. When graphs are plotted, usually an implicit assumption is made that all other factors are being held constant. This "other-things-equal" or *ceteris paribus* assumption is used to simplify the analysis so the study can focus on the two variables of interest.
6. The *slope of a straight line* in a two-variable graph is the ratio of the vertical change to the horizontal change between two points.
- a. A *positive slope* indicates that the relationship between the two variables is *direct*.
- b. A *negative slope* indicates that there is an *inverse* relationship between the two variables.
- c. Slopes are affected by the *measurement units* for either variable.
- d. Slopes measure *marginal changes*.
- e. Slopes can be *infinite* (line parallel to vertical axis) or zero (line parallel to horizontal axis).
7. The *vertical intercept* of a straight line in a two-variable graph is the point where the line intersects the vertical axis of the graph.
8. The slope and intercept of a straight line can be expressed in the form of a *linear equation*, which is written as  $y = a + bx$ . Once the values for the intercept ( $a$ ) and the slope ( $b$ ) are calculated, then given any value of the independent variable ( $x$ ), the value of the dependent variable ( $y$ ) can be determined.
9. The slope of a straight line is constant, but the slope of a *nonlinear curve* at a point, the slope of a line *tangent* to the curve at that point is calculated.
10. HINTS AND TIPS
1. This appendix will help you understand the graphs and problems presented throughout the book. Do not skip reading the appendix or working on the self-test questions and problems in this *Study Guide*. The time you invest now will pay off in improved understanding in later chapters. Graphing is a basic skill for economic analysis.
2. Positive and negative relationships in graphs often confuse students. To overcome this confusion, draw a

### IMPORTANT TERMS

independent variable	vertical axis
slope of a straight line	horizontal axis
vertical intercept	direct (positive) relationship
linear equation	inverse (negative) relationship
nonlinear curve	dependent variable

### SELF-TEST

### FILL-IN QUESTIONS

1. The relationship between two economic variables can be visualized with the aid of a two-dimensional (graph, matrix) \_\_\_\_\_, which has (a horizontal, an inverse) \_\_\_\_\_ axis and a (vertical, direct) \_\_\_\_\_ axis.
2. Customarily, the \_\_\_\_\_ (dependent, independent) variable is placed on the horizontal axis and the \_\_\_\_\_ variable is said to change because of a change in the \_\_\_\_\_ variable.
3. The vertical and horizontal (scales, ranges) \_\_\_\_\_ of the graph are calibrated to reflect the \_\_\_\_\_ of values in the table of data points on which the graph is based.
4. The graph of a straight line that slopes downward to the right indicates that there is (a direct, an inverse) \_\_\_\_\_ relationship between the two variables. A graph of a straight line that slopes upward to the right tells us that the relationship is (direct, inverse) \_\_\_\_\_. When the value of one variable increases and the value of the other variable increases, then the relationship is \_\_\_\_\_. When the value of one variable increases, while the other decreases, the relationship is \_\_\_\_\_. When interpreting an economic graph, the "cause" or the "source" is the (dependent, independent) \_\_\_\_\_ variable and the "effect" or "outcome" is the \_\_\_\_\_ variable.

- two-variable graph with a positive slope and another two-variable graph with a negative slope. In each graph, show what happens to the value of one variable when there is a change in the value of the other variable.
3. A straight line in a two-variable graph can be expressed in an equation. Make sure you know how to interpret each part of the linear equation.

6. Other variables, beyond the two in a two-dimensional graph, that might affect the economic relationship are assumed to be (changing, held constant) \_\_\_\_\_.

This assumption is also referred to as the other-things-equal assumption or as (*post hoc*, *ceteris paribus*) \_\_\_\_\_.

7. The slope of a straight line between two points is defined as the ratio of the (vertical, horizontal) \_\_\_\_\_ change to the \_\_\_\_\_ change.

8. When two variables move in the same direction, the slope will be (negative, positive) \_\_\_\_\_; when the variables move in opposite directions, the slope will be \_\_\_\_\_.

9. The slope of a line will be affected by the (units of measurement, vertical intercept) \_\_\_\_\_.

10. The concept of a slope is important to economists because it reflects the influence of a (marginal, total) \_\_\_\_\_ change in one variable on another variable.

11. A graph of a line with an infinite slope is (horizontal, vertical) \_\_\_\_\_, while a graph of a line with a zero slope is \_\_\_\_\_.

12. The point at which the slope of the line meets the vertical axis is called the vertical (tangent, intercept) \_\_\_\_\_.

13. We can express the graph of a straight line with a linear equation that can be written as  $y = a + bx$ .

a.  $a$  is the (slope, intercept) \_\_\_\_\_ and  $b$  is the \_\_\_\_\_.

b.  $y$  is the (dependent, independent) \_\_\_\_\_ variable and  $x$  is the \_\_\_\_\_ variable.

c. If  $a$  were 2,  $b$  were 4, and  $x$  were 5, then  $y$  would be \_\_\_\_\_. If the value of  $x$  changed to 7, then  $y$  would be \_\_\_\_\_. If the value of  $x$  changed to 3, then  $y$  would be \_\_\_\_\_.

14. The slope of a (straight line, nonlinear curve) \_\_\_\_\_ is constant throughout; the slope of a \_\_\_\_\_ varies from point to point.

15. An estimate of the slope of a nonlinear curve at a certain point can be made by calculating the slope of a straight line that is (tangent, perpendicular) \_\_\_\_\_ to the point on the curve.

#### ■ TRUE-FALSE QUESTIONS

Circle T if the statement is true, F if it is false.

1. Economists design graphs to confuse people. T F

2. If the straight line on a two-variable graph slopes downward to the right, then there is a positive relationship between the two variables. T F

3. A variable that changes as a consequence of a change in another variable is considered a dependent variable. T F

4. Economists always put the independent variable on the horizontal axis and the dependent variable on the vertical axis of a two-variable graph. T F

5. *Ceteris paribus* means that other variables are changing at the same time. T F

6. In the ratio for the calculation of the slope of a straight line, the vertical change is in the numerator and the horizontal change is in the denominator. T F

7. If the slope of the linear relationship between consumption and income was .90, then it tells us that for every \$1 increase in income there will be a \$.90 increase in consumption. T F

8. The slope of a straight line in a two-variable graph will *not* be affected by the choice of the units for either variable. T F

9. The slopes of lines measure marginal changes. T F

10. Assume in a graph that price is on the vertical axis and quantity is on the horizontal axis. The absence of a relationship between price and quantity would be a straight line parallel to the horizontal axis. T F

11. A line with an infinite slope in a two-variable graph is parallel to the horizontal axis. T F

12. In a two-variable graph, income is graphed on the vertical axis and the quantity of snow is graphed on the horizontal axis. If income was independent of the quantity of snow, then this independence would be represented by a line parallel to the horizontal axis. T F

13. If a linear equation is  $y = 10 + 5x$ , the vertical intercept is 5. T F

14. When a line is tangent to a nonlinear curve, then it intersects the curve at a particular point. T F

15. If the slope of a straight line on a two-variable ( $x$ ,  $y$ ) graph were .5 and the vertical intercept were 5, then a value of 10 for  $x$  would mean that  $y$  is also 10. T F

16. A slope of -4 for a straight line in a two-variable graph indicates that there is an inverse relationship between the two variables. T F

17. If  $x$  is an independent variable and  $y$  is a dependent variable, then a change in  $y$  results in a change in  $x$ . T F

18. An upward slope for a straight line that is tangent to a nonlinear curve indicates that the slope of the nonlinear curve at that point is positive. T F

19. If one pair of  $x$ ,  $y$  points was (13, 10) and the other pair was (8, 20), then the slope of the straight line between

the two sets of points in the two-variable graph, with  $x$  on the horizontal axis and  $y$  on the vertical axis, would be 2. T F

20. When the value of  $x$  is 2, a value of 10 for  $y$  would be calculated from a linear equation of  $y = -2 + 6x$ . T F

### ■ MULTIPLE-CHOICE QUESTIONS

Circle the letter that corresponds to the best answer.

1. If an increase in one variable is associated with a decrease in another variable, then we can conclude that the variables are

- (a) nonlinear
- (b) directly related
- (c) inversely related
- (d) positively related

2. The ratio of the vertical change to the horizontal change between two points of a straight line is the

- (a) slope
- (b) vertical intercept
- (c) horizontal intercept
- (d) point of tangency

3. There are two sets of  $x, y$  points on a straight line in a two-variable graph, with  $y$  on the vertical axis and  $x$  on the horizontal axis. If one set of points was (0, 5) and the other set (5, 20), the linear equation for the line would be

- (a)  $y = 5x$
- (b)  $y = 5 + 3x$
- (c)  $y = 5 + 15x$
- (d)  $y = 5 + .33x$

4. In a two-variable graph of data on the price and quantity of a product, economists place

- (a) price on the horizontal axis because it is the independent variable and quantity on the vertical axis because it is the dependent variable
- (b) price on the vertical axis because it is the dependent variable, and quantity on the horizontal axis because it is the independent variable
- (c) price on the vertical axis even though it is the independent variable and quantity on the horizontal axis even though it is the dependent variable
- (d) price on the horizontal axis even though it is the dependent variable and quantity on the vertical axis even though it is the independent variable

5. In a two-dimensional graph of the relationship between two economic variables, an assumption is usually made that

- (a) both variables are linear
- (b) both variables are nonlinear
- (c) other variables are held constant
- (d) other variables are permitted to change

6. If the slope of a straight line is zero, then the straight line is

- (a) vertical
- (b) horizontal

- (c) upward sloping
- (d) downward sloping

Questions 7, 8, 9, and 10 are based on the following four data sets. In each set, the independent variable is in the left column and the dependent variable is in the right column.

(1)		(2)		(3)		(4)	
A	B	C	D	E	F	G	H
0	1	0	12	4	5	0	4
3	2	5	8	6	10	1	3
6	3	10	4	8	15	2	2
9	4	15	0	10	20	3	1

7. There is an inverse relationship between the independent and dependent variables in data sets

- (a) 1 and 4
- (b) 2 and 3
- (c) 1 and 3
- (d) 2 and 4

8. The vertical intercept is 4 in data set

- (a) 1
- (b) 2
- (c) 3
- (d) 4

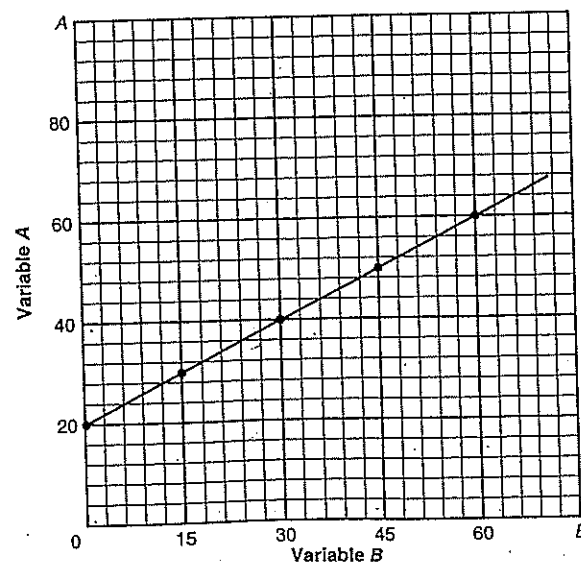
9. The linear equation for data set 1 is

- (a)  $B = 3A$
- (b)  $B = 1 + 3A$
- (c)  $B = 1 + .33A$
- (d)  $A = 1 + .33B$

10. The linear equation for data set 2 is

- (a)  $C = 12 - 1.25D$
- (b)  $D = 12 + 1.25C$
- (c)  $D = 12 - .80C$
- (d)  $C = 12 - .80D$

Answer Questions 11, 12, 13, and 14 on the basis of the following diagram.



11. The variables  $A$  and  $B$  are.

- (a) positively related
- (b) negatively related
- (c) indirectly related
- (d) nonlinear

12. The slope of the line is

- (a) .33
- (b) .67
- (c) 1.50
- (d) 3.00

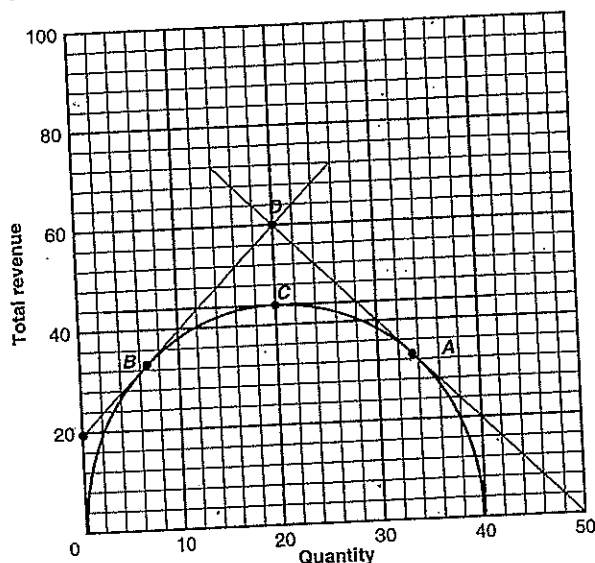
13. The vertical intercept is

- (a) 80
- (b) 60
- (c) 40
- (d) 20.

14. The linear equation for the slope of the line is

- (a)  $A = 20 + .33B$
- (b)  $B = 20 + .33A$
- (c)  $A = 20 + .67B$
- (d)  $B = 20 + .67A$

Answer Questions 15, 16, and 17 on the basis of the following diagram.



15. The slope of the line tangent to the curve at point A is

- (a) 2
- (b) -2
- (c) -1.5
- (d) -0.5

16. The slope of the line tangent to the curve at point B is

- (a) -2
- (b) 2
- (c) 3
- (d) 0.5

17. The slope of the line tangent to the curve at point C is

- (a) -1
- (b) 1
- (c) 0
- (d) undefined

18. Assume that the relationship between concert ticket prices and attendance is expressed in the equation  $P = 25 - 1.25Q$ , where  $P$  equals ticket price and  $Q$  equals concert attendance in thousands of people. On the basis of this equation, it can be said that

- (a) more people will attend the concert when the price is high compared to when the price is low
- (b) if 12,000 people attended the concert, then the ticket price was \$10
- (c) if 18,000 people attend the concert, then entry into the concert was free
- (d) an increase in ticket price by \$5 reduces concert attendance by 1000 people

19. If you know that the equation relating consumption ( $C$ ) to income ( $Y$ ) is  $C = \$7,500 + .2Y$ , then

- (a) consumption is inversely related to income
- (b) consumption is the independent variable and income is the dependent variable
- (c) if income is \$15,000, then consumption is \$10,500
- (d) if consumption is \$30,000, then income is \$10,000

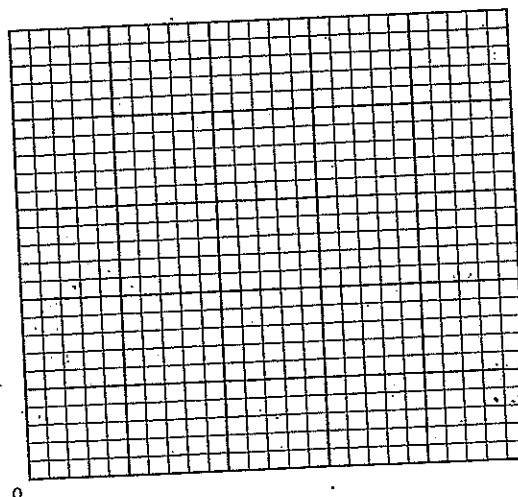
20. If the dependent variable changes by 22 units when the independent variable changes by 12 units, then the slope of the line is

- (a) 0.56
- (b) 1.83
- (c) 2.00
- (d) 3.27

### PROBLEMS

1. Following are three tables for making graphs. On the graphs, plot the economic relationships contained in each table. Be sure to label each axis of the graph and indicate the unit measurement and scale used on each axis.

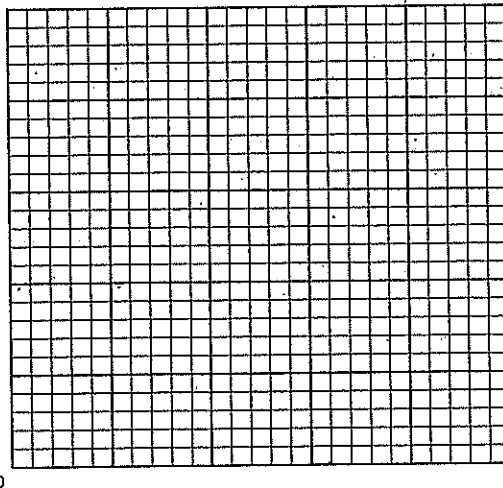
a. Use the table at the top of the next page to graph national income on the horizontal axis and consumption expenditures on the vertical axis in the graph below; connect the seven points and label the curve "Consumption." The relationship between income and consumption is (a direct, an inverse) \_\_\_\_\_ one and the consumption curve is (an up-, a down-) \_\_\_\_\_ sloping curve.



National income, billions of dollars	Consumption expenditures, billions of dollars
\$ 600	\$ 600
700	640
800	780
900	870
1000	960
1100	1050
1200	1140

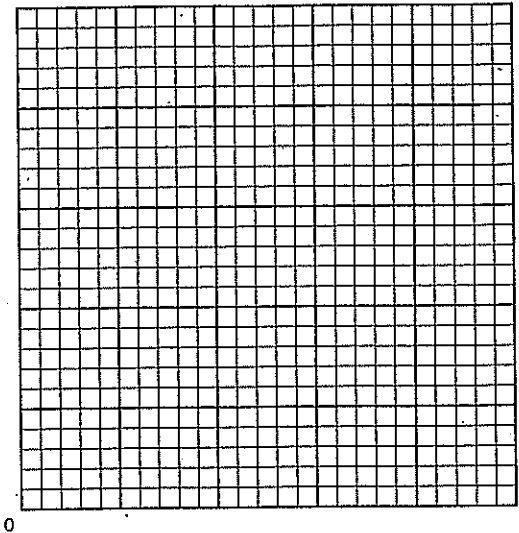
b. Use the next table to graph investment expenditures on the horizontal axis and the rate of interest on the vertical axis on the graph below; connect the seven points and label the curve "Investment." The relationship between the rate of interest and investment expenditures is (a direct, an inverse) \_\_\_\_\_ one and the investment curve is (an up-, a down-) \_\_\_\_\_ sloping curve.

Rate of interest, %	Investment expenditures, billions of dollars
8	\$220
7	280
6	330
5	370
4	400
3	420
2	430



c. Use the next table to graph average income on the horizontal axis and milk consumption on the vertical axis on the graph in the next column; connect the seven points.

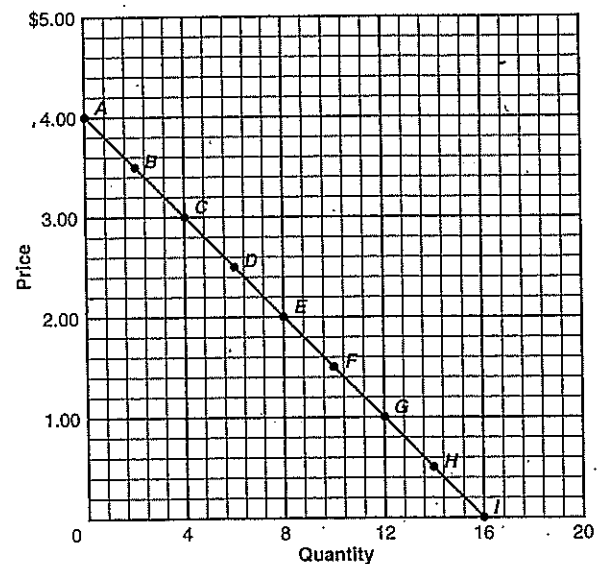
Average income	Annual per capita milk consumption in gallons
\$62,000	11.5
63,000	11.6
64,000	11.7
65,000	11.8
66,000	11.9
67,000	12.0
68,000	12.1



Based on the data, the average income and milk consumption (are, are not) \_\_\_\_\_ correlated.

The higher average income (is, is not) \_\_\_\_\_ the cause of the greater consumption of milk because the relationship between the two variables may be purely (coincidental, planned) \_\_\_\_\_.

2. This question is based on the following graph.



a. Construct a table for points A-I from the data shown in the graph.

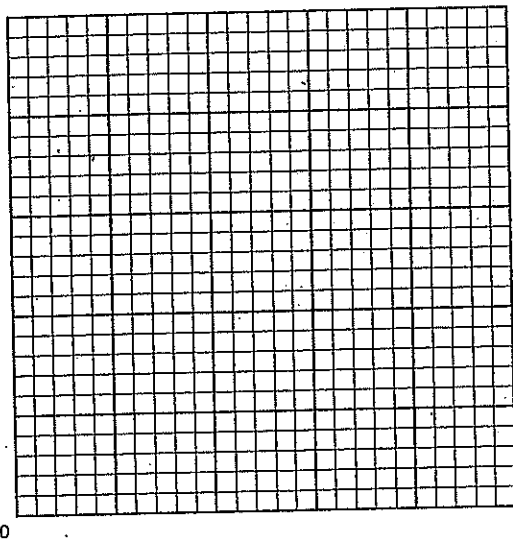
b. According to economists, price is the (independent, dependent) \_\_\_\_\_ variable and quantity is the \_\_\_\_\_ variable.

c. Write a linear equation that summarizes the data.

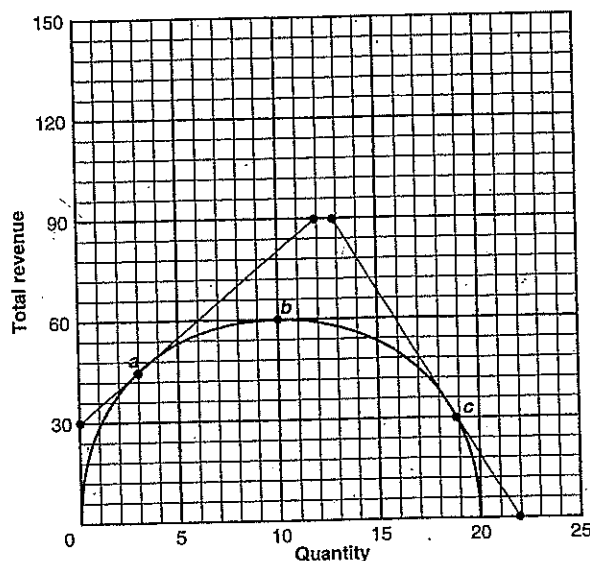
3. The following three sets of data each show the relationship between an independent variable and a dependent variable. For each set, the independent variable is in the left column and the dependent variable is in the right column.

(1)		(2)		(3)	
A	B	C	D	E	F
0	10	0	100	0	20
10	30	10	75	50	40
20	50	20	50	100	60
30	70	30	25	150	80
40	90	40	0	200	100

- Write an equation that summarizes the data for each of the sets (1), (2), and (3).
- State whether each data set shows a positive or an inverse relationship between the two variables.
- Plot data sets 1 and 2 on the following graph. Use the same horizontal scale for both sets of independent variables and the same vertical scale for both sets of dependent variables.



4. This problem is based on the following graph.



- The slope of the straight line through point *a* is?
- The slope of the straight line through point *b* is?
- The slope of the straight line through point *c* is?

#### ■ SHORT ANSWER AND ESSAY QUESTIONS

- Why do economists use graphs in their work?
- Give two examples of a graph that illustrates the relationship between two economic variables.
- What does the slope tell you about a straight line? How would you interpret a slope of 4? A slope of -2? A slope of .5? A slope of -.25?
- If the vertical intercept increases in value but the slope of a straight line stays the same, what happens to the graph of the line? If the vertical intercept decreases in value, what will happen to the line?
- How do you interpret a vertical line on a two-variable graph? How do you interpret a horizontal line?
- When you know that the price and quantity of a product are inversely related, what does this tell you about the slope of a line where price is on the vertical axis and quantity is on the horizontal axis? What do you know about the slope when the two variables are positively related?
- Which variable is the dependent and which is the independent in the following economic statement: "A decrease in business taxes had a positive effect on investment spending."
- How do you tell the difference between a dependent and independent variable when examining economic relationships?
- Why is an assumption made that all other variables are held constant when we construct a two-variable graph of the price and quantity of a product?
- How do mathematicians and economists differ at times in how they construct two-dimensional graphs? Give an example.
- How is the slope of a straight line in a two-variable graph affected by the choice of the units for either variable? Explain and give an example.
- What is the relationship between the slopes of lines and marginal analysis?
- Describe a case in which a straight line in a two-variable graph would have an infinite slope and a case in which the slope of a line would be zero.
- If you know that the equation relating consumption (*C*) to income (*Y*) is  $C = 10,000 + .5Y$ , then what would consumption be when income is \$5000? Construct an income-consumption table for five different levels of income.
- How do the slopes of a straight line and a nonlinear curve differ? How do you estimate the slope of a nonlinear curve?



## ANSWERS

## Appendix to Chapter 1 Graphs and Their Meaning

## FILL-IN QUESTIONS

- graph, a horizontal, vertical
- independent, dependent, dependent, independent
- scales, ranges
- an inverse, direct, direct, inverse
- independent, dependent
- held constant, *ceteris paribus*
- vertical; horizontal
- positive, negative
- units of measurement
- marginal
- vertical, horizontal
- intercept
- a. intercept, slope; b. dependent, independent; c. 22, 30, 14
- straight line, nonlinear curve
- tangent

## TRUE-FALSE QUESTIONS

- |                 |                  |                  |
|-----------------|------------------|------------------|
| 1. F, p. 22     | 8. F, p. 24      | 15. T, p. 25     |
| 2. F, p. 23     | 9. T, p. 24      | 16. T, p. 24     |
| 3. T, p. 23     | 10. T, pp. 24-25 | 17. F, p. 23     |
| 4. F, p. 23     | 11. F, pp. 24-25 | 18. T, pp. 25-26 |
| 5. F, pp. 23-24 | 12. T, pp. 24-25 | 19. F, p. 25     |
| 6. T, p. 24     | 13. F, p. 25     | 20. T, p. 25     |
| 7. T, p. 24     | 14. F, pp. 25-26 |                  |

## MULTIPLE-CHOICE QUESTIONS

- |                 |              |                  |
|-----------------|--------------|------------------|
| 1. c, p. 23     | 8. d, p. 25  | 15. b, pp. 25-26 |
| 2. a, p. 24     | 9. c, p. 25  | 16. b, pp. 25-26 |
| 3. b, p. 25     | 10. c, p. 25 | 17. c, pp. 25-26 |
| 4. c, p. 23     | 11. a, p. 23 | 18. b, p. 25     |
| 5. c, pp. 23-24 | 12. b, p. 24 | 19. c, p. 25     |
| 6. b, pp. 24-25 | 13. d, p. 25 | 20. b, p. 24     |
| 7. d, p. 23     | 14. c, p. 25 |                  |

## PROBLEMS

- a. a direct, an up-; b. an inverse, a down-; c. are, is not, coincidental
- a. table below; b. independent, dependent; c.  $P = 4.00 - .25Q$

Point	Price	Quantity
A	\$4.00	0
B	3.50	2
C	3.00	4
D	2.50	6
E	2.00	8
F	1.50	10
G	1.00	12
H	.50	14
I	.00	16

- a. (1)  $B = 10 + 2A$ ; (2)  $D = 100 - 2.5C$ ; (3)  $F = 20 + .4E$   
b. (1) positive; (2) inverse; (3) positive
- a. 5; b. 0; c. -10

## SHORT ANSWER AND ESSAY QUESTIONS

- |              |              |               |
|--------------|--------------|---------------|
| 1. p. 22     | 6. p. 24     | 11. p. 24     |
| 2. pp. 22-23 | 7. p. 23     | 12. p. 24     |
| 3. p. 24     | 8. p. 23     | 13. pp. 24-25 |
| 4. p. 25     | 9. pp. 23-24 | 14. p. 25     |
| 5. p. 25     | 10. p. 23    | 15. pp. 25-26 |

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